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PROGRAM MANAGER:
JOINT OCEANOGRAPHIC INSTITUTIONS
1755 Massachusetts Avenue, NW, Suite 800
Washington, DC 20036-2102 USA
Tel: (202) 232-3900
Fax: (202) 232-8203
E-mail: joi@brook.edu
www.joi-odp.org

SCIENTIFIC PLANNING:
JOIDES OFFICE
Woods Hole Oceanographic Institution
Geology and Geophysics Department, MS #22
Woods Hole, MA 02543 USA
Tel: (508) 289-3481
Fax: (508) 457-2187
E-mail: joides@whoi.edu
www.whoi.edu/joides

SCIENCE OPERATOR:
TEXAS A&M UNIVERSITY
Ocean Drilling Program
1000 Discovery Drive
College Station, TX 77845-9547 USA
Tel: (409) 845-2673
Fax: (409) 845-4857
www-odp.tamu.edu

LOGGING OPERATOR:
LAMONT-DOHERTY EARTH OBSERVATORY
Borehole Research Group
Palisades, NY 10964 USA
Tel: (914) 365-8672
Fax: (914) 365-3182
E-mail: borehole@ldeo.columbia.edu
www.ldeo.columbia.edu/BRG/brg_home.html

Media Contacts:
Pamela Baker- Masson
c/o Tulip Inn Hotel, Cape Town
(21) 23 51 16 (until Oct. 12) or
(202) 232-3900 ext. 226
pbaker@brook.edu

Aaron Woods
(409) 845-9322
aaron_woods@odp.tamu.edu

FOR IMMEDIATE RELEASE

Ocean Floor Offers Scientists Clues To Southern African Climate

To better understand climate change in the Atlantic realm, scientists collected and studied sediments from beneath the sea floor off southern Africa, during a recent Ocean Drilling Program (ODP) expedition between the mouth of the Congo River and the Cape of Good Hope. This strip of coastal ocean is well-known for cold water and high productivity. The climatic zones on the adjacent land include tropical rain forest in the Congo Basin and extremely dry desert in Namibia. The Namib owes its existence to the upwelling of cold water at the coast, which produces a high pressure region over the coastal ocean that blocks moist winds from entering the African continent.

The scientists seek to understand changes in the wind fields over the past 10 million years, and the effects on African climate and northward transport of heat within the ocean. "The intensity of upwelling directly reflects the intensity of winds, and the precipitation in western Africa," explains co-chief scientist Dr. Gerold Wefer of the University of Bremen (Germany). "And, in turn, the winds drive the mighty Benguela Current, the strongest in the South Atlantic." During the expedition aboard the world's largest scientific drill ship *JOIDES Resolution*, the scientific party recovered more than seven kilometres of core material.

The powerful hurricanes in the Caribbean are caused, in part, by the surface-current transfer of heat from the South to the North Atlantic via currents such as the Benguela. "The South Atlantic sends heat to the North Atlantic, and that is why there are no hurricanes in the South Atlantic," says Dr. Wolf Berger of Scripps Institution of Oceanography, University of California, San Diego, US, the other co-chief scientist. "We need to reconstruct the history of this heat transfer, to understand what controls it, and how sensitive it is to climatic change. There are indications that human activity is changing the climate. We wish to know how resilient the natural system is to such modifications."

Upwelling of ocean water releases carbon dioxide to the atmosphere and greatly intensifies the biological activity in the area, bringing to the surface nutrient-rich waters which fuel high productivity of plankton and the marine life that depends on plankton for food. "These sediments contain the remains of plankton which once fed whales and fish," says Berger. When sinking out of the sunlit zone, the organic plankton remains carry carbon from the surface layer of the ocean into the sediment on the sea floor. This transfer of carbon to the ocean bottom, the so-called "biological pump", modifies the level of carbon dioxide in the atmosphere, an important control of climate. Another focus is on the ultimate fate of the organic material. Of special interest in this context are the thick sequences of gas-rich and carbon-rich black sediments found off LÅderitz Bay, a region of intense upwelling.

"The accumulation of organic matter in the sediments is the first step towards the genesis of oil and gas," says Berger. "The oil fields now producing off Congo and Angola owe their existence to the accumulation of plankton remains some 100 million years ago, when the South Atlantic was in the early stages of opening up, through continental drift."

Twenty-five ODP scientists from universities in the United States, Germany, Japan, France, Great Britain, Canada, Sweden, the Netherlands, Chinese Taipei, Angola, and South Africa, examined the links between climate and productivity as seen in the sediments. The expedition represented an important opportunity for scientists in the early stages of their career to

participate in exciting discoveries and to network internationally. Ms. Rochelle Wigley, University of Cape Town, was invited to join this research expedition as an observer since drilling took place in South African territorial waters.

"As a South African geologist I am extremely grateful for this unique opportunity to work with some of the best international scientists doing forefront research in Earth and Ocean Sciences," states Ms. Wigley, "During this expedition, I came to really appreciate the importance of the Agulhas and Benguela Currents in the history of global ocean circulation and African climate change. It is the best on-the-job education imaginable. I hope that many other young South African scientists will be offered a similar opportunity in the future."

Highlights of the many discoveries made during the expedition include:
- Evidence for a strong tie-in of variations in productivity in the Angola Basin to fluctuations in the monsoonal activity in North Africa.

- The presence of a record in the sediments of the Congo River of dry-wet cycles in its drainage basin in the heart of Africa.

- Evidence for large-scale changes in the strength of the Benguela Current.

- Evidence for great changes in the intensity of upwelling off Namibia, with a maximum shortly after the great cooling step that initiated northern hemisphere glaciation, 2.8 million years ago.

- Evidence for intense chemical activity within the sediments, which leads to the production of gas (methane, carbon dioxide) and the formation of new minerals. One of the most interesting discoveries, in this context, was the realization that banks of hard rock, made of dolomite, form within the soft organic-rich sediment. These layers extend over large areas and greatly impact the ability of sediments to reflect sound. Logging (the measurement of sediment properties within the open hole, by remotely controlled instruments) proved the case for the abundance of dolomite banks. It was difficult to retrieve the material by drilling, because of its hardness.

"We had no idea that dolomite layers were important in generating seismic reflectors in this area. We will have to completely revise our interpretation of the echoes returned from within the sediment," says Volkhard Spiess, University of Bremen, the geophysicist who helped select the drill sites. These findings will be important in guiding geophysical exploration for oil and gas, by industry.

The Ocean Drilling Program, an international partnership of scientific institutions and governments, explores the history and evolution of Earth's crust. The Ocean Drilling Program is funded principally by the National Science Foundation, with substantial contributions from its international partners. These include the Federal Republic of Germany, France, Japan, and the United Kingdom. Australia, Canada, Chinese Taipei, and Korea hold a joint partnership. Another partner is the European Science Foundation, consisting of Belgium, Denmark, Finland, Iceland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and Turkey. The program is managed by Joint Oceanographic Institutions, a consortium of 10 U.S. institutions, with Texas A&M University responsible for science operations. Lamont-Doherty Earth Observatory is the operator for downhole logging.

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